

WHAT IS CLAIMED IS

1. A hydraulic transmission apparatus with a lockup clutch comprising:

5 a pump impeller driven by an engine;

a turbine runner forming a circulation circuit between the pump impeller and the turbine runner and driving an output shaft;

10 a side cover provided continuously to the pump impeller so as to form a clutch chamber communicating with an outer circumferential portion of the circulation circuit between an outer surface of the turbine runner and the side cover;

15 a lockup clutch disposed in the clutch chamber so as to establish a direct connection between the side cover and the turbine runner;

a clutch piston axially movably coupled to the turbine runner so as to divide the clutch chamber into inner fluid chamber of a turbine runner side and outer fluid chamber of a side cover side;

20 a lockup control unit for generating a pressure difference between the inner fluid chamber and the outer fluid chamber so as to move the clutch piston forwards and backwards relative to an inner surface of the side cover using fluid supplied from an oil pump driven by the engine
25 to the circulation circuit;

a frictional engagement unit for establishing and cutting off an engagement between the clutch piston and the side cover in response to forward and backward movements of the clutch piston relative to the inner surface of the side cover;

a resilient member disposed between the clutch piston and the turbine runner for biasing the clutch piston in a forward direction; and

a backward movement stopping unit is provided between the clutch piston and the turbine runner for restricting a predetermined backward position for the clutch piston to put the frictional engagement unit in a cut-off state,

wherein a transmission capacity of the lockup clutch by virtue of a biasing force of the resilient member is set smaller than a torque absorption capacity of the pump impeller when the engine is in an idle state so that the clutch piston is held at the predetermined backward position by virtue of the pressure difference when the engine is in the idle state.

2. A hydraulic transmission apparatus with a lockup clutch as set forth in Claim 1, wherein the clutch piston includes:

a piston outer circumferential-side member having a larger portion of a side wall of the clutch piston located on

an outer circumferential side thereof; and

a piston inner circumferential-side member having:

a smaller portion of the side wall located on an inner circumferential side thereof; and

5 a hub piston protruding from an inner circumferential end of the smaller portion towards the turbine runner,

wherein a surface of the hub piston is imparted surface-hardening treatment,

10 wherein the both members fit in each other and are welded together so as to be integral.

3. A hydraulic transmission apparatus with a lockup clutch as set forth in Claim 2, wherein the surface-hardening treatment
15 is carbonitriding or induction hardening.

4. A hydraulic transmission apparatus with a lockup clutch as set forth in Claim 1, wherein a capacity ratio satisfies an inequality;

20 $A / B \leq 0.15$

wherein A represents the transmission capacity of the lockup clutch and B represents the torque absorption capacity of the pump impeller.